MiniCAM

Last Revision Date: 11/16/2009

General Information

Model Abbreviated Name: MiniCAM

Model Extended Name: MiniCAM

Model Overview/Abstract:
MiniCAM has become GCAM http://cfpub.epa.gov/crem/knowledge_base/crem_report.cfm?deid=212503

MiniCAM is a partial-equilibrium model (energy and land-use) including numerous energy supply technologies, agriculture and land-use model, and a reduced-form climate model. Emissions include CO2, CH4, N2O, and SO2. 15-year timestep, over the period 1990 - 2095.

MiniCAM integrates four existing models. The Edmonds-Reilly-Barns (ERB) energy-economic model represents long-term trends in economic output, energy use, and greenhouse gas emissions for nine world regions through detailed submodules representing energy resources, primary energy supply and demand, energy markets including world trade and electricity conversion; atmospheric composition and global-mean climate changes using the (MAGICC), and SCENHEN which models the regional patterns of climate change and rhe agriculture and land-use model (AgLU), and fuel-specific emissions factors.

MiniCAM enhances the ability to understand the impact of technologies and policies related to GHG emissions in a national and global context, including the ability to quickly evaluate technologies including carbon sequestration. In the model, biomass land competes with food and fiber uses in the agriculture/land-use model. The MAGICC component provides GHG concentrations, radiative forcing, and climate change. The flexible object- oriented structure allows new technologies and sectors to be quickly implemented.

Keywords:

Model Technical Contact Information:
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Model Homepage: http://sedac.ciesin.org/mva/minicam/MCHP.html

User Information

Technical Requirements

Computer Hardware
This model runs on a desktop computer.

Compatible Operating Systems
Windows

Using the Model

Basic Model Inputs
For a description of the multiple inputs see PNNL-14337, "Model Documentation for the MiniCAM," Brenkert, Smith, Kim, and Pitcher. 2003

Basic Model Outputs
The model produces emissions of greenhouse gases (carbon dioxide, methane and nitrous oxide) and other radiatively important substances such as sulfur dioxide. Through incorporation of the simple climate model MAGICC, the consequences of these emissions for climate change and sea-level rise can be examined. The MiniCAM is designed to be fast and flexible.

User Support

User's Guide Available?
Edmonds, J., and J. Reilly (1985)Global Energy: Assessing the Future (Oxford University Press, New York) pp.317.

Model Science

Problem Identification
MiniCAM is composed of two component models. Energy-related greenhouse-gas emissions are determined using the Edmonds-Reilly-Barns (ERB) model first developed at Oak Ridge National Laboratory. Atmospheric composition, radiative forcing, global mean temperature change, and sea- level rise are assessed using the Model for the Assessment of Greenhouse- gas Induced Climate Change (MAGICC), developed by Tom Wigley of the National Center for Atmospheric Research (NCAR).

Summary of Model Structure and Methods
Technologies utilized in the miniCAM include:

- Electric generation (Coal, Oil, Gas, Biomass, Hydro, Nuclear, Wind, Solar PV)
- Hydrogen production (Coal, Oil, Gas, Biomass, Electrolysis)
- Synthetic fuels (liquids and gases from coal, oil, gas, biomass)
- Geologic carbon sequestration from fossil fuels (electric generation, hydrogen generation, synthetic fuel production)
- Tradiational, residue, and biomass crops (generated regionally by an AgLU Model)

Energy demand is based on technology-based U.S. end-use sectors. Transportation by mode (Passenger: light duty vehicles, bus, train, air, motorcycle; Freight: truck, ship, rail, air) and technology (e.g., ICE cars, ICE light trucks, hybrid cars, electric cars, fuel-cell cars). Separate commercial and residential buildings by service (heating, cooling, lighting, hot water, other) and technology (e.g., gas or oil furnace, electric baseboard, electric heat pump). Industrial energy use by sector (9 manufacturing sectors; 4 non-manufacturing) and end-use (boilers, process heat, machine drive, HVAC, electro-chemical, feedstocks, other).

The MiniCAM is implemented within the Object-Oriented Energy, Climate, and Technology Systems (ObjECTS) framework. ObjECTS is a flexible, modular, Integrated Assessment modeling framework. The component- based structure of this model represents global energy, land-use, and economic systems through a component hierarchy that aggregates detailed technology information up to a global macroeconomic level. Input is provided by the flexible XML standard, where data is structured in an object hierarchy that parallels the model structure.

Model Evaluation
The MiniCAM has been evaluated and reviewed in several peer-reviewed Publications, including the following:

Edmonds, J., and J. Reilly (1985)*Global Energy: Assessing the Future* (Oxford University Press, New York) pp.317.

Edmonds, J., M. Wise, H. Pitcher, R. Richels, T. Wigley, and C. MacCracken. (1997) "An Integrated Assessment of Climate Change and the Accelerated Introduction of Advanced Energy Technologies", *Mitigation and Adaptation Strategies for Global Change*, 1, pp. 311-39

Kim, S.H., J. Edmonds, J. Lurz, S. J. Smith, and M. Wise (2006) "The ObjECTS Framework for Integrated Assessment: Hybrid Modeling of Transportation "*Energy Journal* (in press).